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(71) WINEPLAS PRODUCTS PTY. LIMITED
(72) DAVIS, G. L.
(74) GH
(56) 81085/75 482816 CO8F HO1B
80858/75 487846 CO8F HO1B
(57) CLAIM 1. A cork substitute formed as a moulding and comprising a homogeneous mixture of: a low density polyethylene, a low density polyethylene co-polymer, and a low density polyethylene compound containing a silicone; such mixture being blown during moulding to provide a moulded shape having a porous structure in at least its interior.

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PATENTS ACT 1952-69

COMPLETE SPECIFICATION

(ORIGINAL)

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504603

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Name of Applicant :

WINEPLAS PRODUCTS PTY. LIMITED

Address of Applicant:

ROOM 1, 291 BELMORE ROAD SOUTH,
RIVERWOOD, NEW SOUTH WALES 2210.

Actual Inventor:

GEOFFREY LIONEL DAVIS

Address for Service:

Griffith, Hassel & Frazer,

323 Castlereagh St.,

SYDNEY N.S.W. 2000 AUSTRALIA

Complete Specification for the invention entitled:

"CORK SUBSTITUTE"

The following statement is a full description of this invention, with the best method of performing it known to me/us:-

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This invention relates to a cork substitute.

Cork has numerous applications because of its lightness, compressibility, natural resilience and moisture imperviousness. One of these applications is the provision of corks for bottles in the wine industry. There are of course other applications such as a thermal lining material, as a shoe soling material and many other others too numerous to mention.

Cork is made from trees and is becoming progressively more expensive. This has lead to the development of products to take the place of cork. However, the inherent qualities of cork have not so far been satisfactorily reproduced by a synthetic product. For example, plastics stoppers for wine bottles have been developed, which employ radial flanges dimensioned to flex sufficiently to reproduce the resilience of cork. However, one cannot open such wine bottles using a conventional cork screw, and such stoppers have not found wide acceptance by the industry or the public.

~~An object of this invention is the provision of a new material having many of the properties of cork and resembling it in appearance.~~

In accordance with one aspect of the invention there is provided a cork substitute formed as a moulding and comprising a homogenous mixture of: a low density polyethylene, a low density polyethylene co-polymer, and a low density polyethylene



compound containing a silicone; such mixture being blown during moulding to provide a moulded shape having a porous structure in at least its interior.

In accordance with a second aspect of the invention there is provided a method of making a cork substitute material comprising injecting under pressure into a refrigerated shaped moulding means a hot, liquid or semi-liquid blend which consists of: a low density polyethylene compound containing about 20% by weight silicone, a non-aqueous wetting agent, a large amount of low density polyethylene and some low density polyethylene co-polymer, and a blowing agent; allowing the blend to dwell in the shape moulding means until blowing has substantially ceased and the moulded product has solidified, opening the shape moulding means and removing the solid product therefrom.

The invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:-

FIGURE 1 is a side view of a bottle closure;
FIGURE 2 is an end view of the closure; and,
FIGURE 3 is a vertical section through the closure.

A bottle closure made of cork substitute material is composed of the following basic ingredients:

<u>% By Weight</u>	<u>Constituent</u>
87%	Low density polyethylene powder (grade XJG143 commercially available from

I.C.I. Australia (Petrochemicals) Limited.)

- 5% Low density polyethylene co-polymer
(commercially available under the trade
name "DPD 6169" marketed by the Union
Carbide Corporation of America.)
- 1% Non-metallic, non-toxic brown pigment
(available as from Ferro Corporation of
Australia.)
- 1% Low density polyethylene compound
containing 20% by weight of silicone
(sold by Fortified Polymers Pty. Limited,
under the trade name RESEX 150 and which
comprises granules of polyethylene
saturated coated with an amount of
silicone).
- 1% Bicarbonate of Soda for use as a blowing
agent.
- 5% Anti-blocking agent ABMB (available from
Union Carbide Corporation Australia).

The above constituents are added together in powdered
form and mixed intimately. Just sufficient methyl alcohol is
then added to wet the powder so as to provide the moulding
mixture.

The moulding mixture is passed through a BOY 7/15
injection moulder of 1½oz capacity operating under the
following temperature conditions:-

Rear and front band temperatures = 250°C

Nozzle temperature = 50°C.

The mixture is injected through an orifice of fifteen thousandth of an inch diameter into a refrigerated die mould having the shape of a cork and at - 40°C. The material is allowed to remain in the die for between 25 and 45 seconds after which time the blowing produced by the bicarbonate of soda has ceased.

The above process is used to provide the headed, bottle closure shown in the Figures and having a length of about 4.5 cm and a spigot 10 diameter of 2cm stepped at 12 and with a head 11 diameter of 3 cm. The closure product has a smooth outside surface 2 with a slightly figured or mottled appearance closely resembling in colour and texture that of a smooth-walled cork as is clearly shown in Figures 1 and 2. The section through the cork shown in Figure 3 shows that its outer thickness 3 is almost devoid of air-bubbles or voids for a depth of about 1.5mm thick. Within this somewhat hardened but still flexible outer sheath is a porous honeycom mass composed of gas bubbles of which the largest are perhaps 2mm diameter. The average gas bubbles diameter increases progressively with distance from the exterior sheath and so that the closure is provided with an intermediate layer 4 of about 2mm thick containing predominantly small air bubbles and having a foraminous appearance and a central core 5 containing some larger air bubbles and of the texture of a fine sponge.

The physical characteristics of the cork substitute material closely resemble cork, in that, if compressed

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indentations are formed which slowly disappear. The outer sheath is not actually broken but rather deformed inwardly at the indentation and is relatively slow to recover its shape. The product has about twice the specific gravity of pure cork but is cheaper. The product does not suffer from migration of moisture along it by capillary action although there are small voids in the surface which enable it to pick up the colour of a wine after a slightly longer time than a conventional cork. The product can be inserted into a wine bottle by conventional corking equipment with only slight modification because it requires rather longer to recover its original shape after being deformed for entry into the bottle than true cork. It also has the great advantage over cork that it is effectively free of grain and weak splitting planes.

A minute or so after the product has been fitted into the neck of a bottle its natural "memory" causes it to completely fill the bottle neck and it then withstands the same compression as a conventional cork and has the same recovery ratio i.e. about 90%, despite its initial slowness in recovering its shape as compared with cork.

Unlike real cork, the product can be fitted and withdrawn from a bottle with a cork screw without risk of crumbling splitting or tearing, and in this respect it is superior to conventional cork. It is also resistant to mould growth.

It is believed that the low density polyethylene compound containing 20% by weight of silicone is an important ingredient in that it gives water-resistance to the closure and provides

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the mottled or figured patterning on the outside which results in the appearance of the product closely resembling that of true cork. It also gives slip to the outer surface of the cork to enable easy entry to and withdrawal from a bottle.

The low density polyethylene co-polymer appears to impart resilience to the cork product to withstand shear forces without crumbling. The low density polyethylene co-polymer gives the cork product the slightly waxy finish of a true cork as well as producing foam, during blowing, when heated with the sodium bicarbonate blowing agent above 170°C.

It appears that the blowing is contained in the barrel of the injection moulder and commences when introduced into the mould itself.

The cork substitute material produced by the invention is usable for many applications where cork has formerly been used. It may, for instance provide a tough filling having a smooth surface which does not suffer from risk of the sheath laminating, from fatigue, from the honeycomb interior. The cork substitute material may be used in the shoe industry as cork sole or as an insulating sheet because it is light and has good temperature-insulating properties. It will also be usable in any area of industry where a light tough durable cork-like product is required, and particularly if there is a requirement for the outside of the product to be smooth and to have a greater resistance to moisture penetration than the interior.

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The proportions of the different ingredients from which the cork substitute material is made can be varied within the following limits whilst still giving a product of generally cork-like appearance and behaviour and some of the above ingredients can be replaced by others in certain circumstances. For example:-

(a) The content of DPD6169 can be reduced from 10% to 1% to increase the cellular structure and lighten the finished product where flexing is not an important factor.

Similarly, the proportion of DPD6169 can be increased to increase the density of the finished product where the end application requires a higher degree of resilience, say up to 10%.

(b) The proportion of bi-carbonate of soda can be varied. Increasing it gives a greater cellular interior structure which could be advantageous in large-area products, i.e. cork like sheeting, although if too much is used degradation of the product will occur.

The claims defining the invention are as follows:-

1. A cork substitute formed as a moulding and comprising a homogeneous mixture of: a low density polyethylene, a low density polyethylene co-polymer, and a low density polyethylene compound containing a silicone; such mixture being blown during moulding to provide a moulded shape having a porous structure in at least its interior.
2. A moulding as set forth in Claim 1, having a smooth mottled outer sheath which is flexible and firm to the touch, a foraminous intermediate layer backing the outer sheath and containing a multiplicity of small gas bubbles, and an inner core containing a higher proportion of larger gas bubbles than said intermediate layer and having a sponge-like appearance, in which moulding the outer sheath is harder than the intermediate layer which is, in turn, harder than the core.
3. A moulding as set forth in Claim 1 or Claim 2, shaped as a bottle cork.
4. A moulding as claimed in Claim 1 or Claim 2, containing an anti-blocking agent.
5. A method of making a cork substitute material comprising injecting under pressure into refrigerated shape moulding means a hot liquid or semi-liquid blend which consists of: a low density polyethylene compound containing about 20% by weight silicone, a non-aqueous wetting agent, low density polyethylene, low density polyethylene co-polymer, and a blowing agent; allowing the blend to dwell in the shape moulding means until blowing has substantially ceased and the



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moulded product has solidified, and removing the solid product therefrom.

6. A method as claimed in Claim 5, in which blowing takes place at a temperature above 170°C.

7. A method as set forth in Claim 6, in which the shape moulding means is connected to an injection moulding device having a die nozzle through which a moulding mixture blend enters said means and has rear and front band temperatures each of 250°C and a nozzle temperature of 50°C.

8. A method as claimed in Claim 7, in which the dwell time of the blend in the mould lies between 25 and 45 seconds.

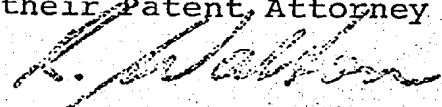
9. A method of making a product having physical characteristics resembling cork, substantially as hereinbefore described with reference to the accompanying drawings.

10. A product made by the method claimed in any one of Claims 5 to 9.

11. A bottle cork made substantially as described with reference to the accompanying drawings.

Dated this 27th day of July, 1979.

WINEPLAS PRODUCTS PTY. LIMITED
by their Patent Attorney



of GRIFFITH HASSEL & FRAZER
Fellows, Institute of Patent
Attorneys of Australia



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FIG. 2

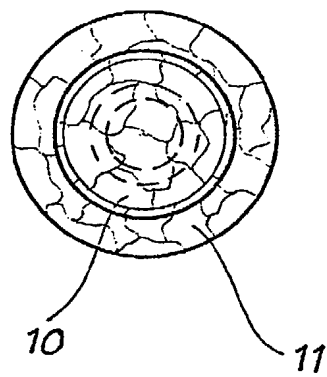


FIG. 1

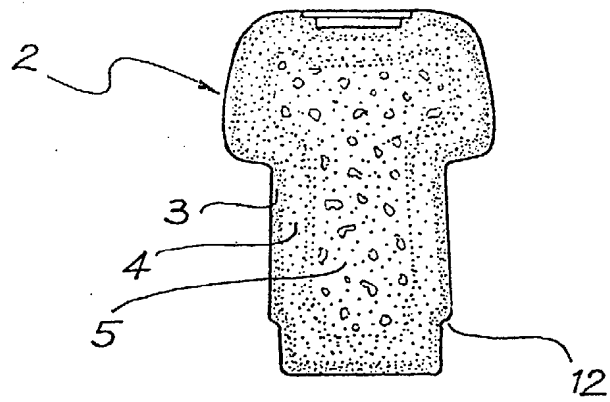
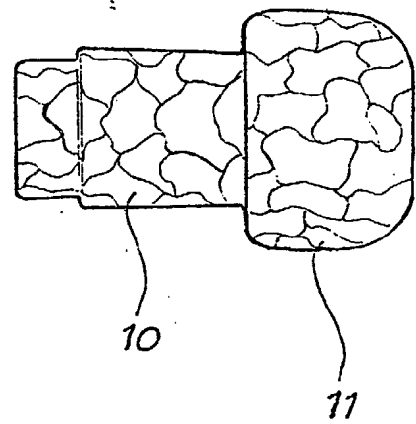


FIG. 3